TITLE OF THE INVENTION

LED SIGNAL WITH SIDE EMITTING STATUS INDICATORS

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a signal that includes side emitting status indicators, and in particular in which the signal includes an LED light source. Such a signal can find application, for example, as a railway indicating signal.

DISCUSSION OF THE BACKGROUND

A typical railway indicating signal utilizes an incandescent light bulb as a light source. Such a railway signal may be employed at a railway crossing. In that type of signal the light emitted from the incandescent light bulb passes through at least one red lens to provide a primary red signal to an oncoming motorist crossing the rail tracks. Also, two additional light ports, one on each side, may be provided to provide objective evidence to a train operator that the light bulb is properly outputting light to the oncoming motorist. That is, an operator on the train can view light output from the additional light ports to confirm that the light bulb in the railway crossing light is properly operating. In that operation the light provided to the additional light ports is directly collected from the light source, i.e., the incandescent light bulb, by an optical window that utilizes prism features, and which refracts light in the desired direction.

SUMMARY OF THE INVENTION

One object of the present invention is to provide a novel signal, such as a railway indicating signal that utilizes an LED light source and that provides an accurate side emitting status indication.

The present inventors have recognized that as LED light sources become more and more available, LED light sources may be utilized in signal applications. However, most LEDs provide substantially directional light. In the context of a railway signal, the light

output by an LED light source may pass through a lens or lenses providing signals to oncoming motorists. In such a case, since the LEDs provide substantially directional light, in a device such as a railway light with side emitting status indicators, there is typically insufficient light reaching the side emitting status indicators for a train operator to view because of the directional nature of the LEDs.

One way to solve that problem is to add additional LEDs to be directed to the side emitting status indicators. However, that approach does not provide a failsafe indication to a train operator since those additional LEDs may not always operate the same as the primary LEDs providing the light signal in a primary direction to an oncoming motorist. That is, the situation may arise that the LEDs providing a light signal in a primary direction to an oncoming motorist are not properly working, but different side facing LEDs providing light in a secondary direction to side emitting status indicators are properly working. In that instance, the train operator would not be given on accurate indication.

Accordingly, a more specific object of the present invention is to provide a novel LED signal with side emitting status indicators that provides a true indication of the light provided in a primary light output direction.

To achieve the above and other objects, the present invention sets forth a novel light device including a light source of at least one LED configured to generate light in a primary direction. A lens device through which the light generated from the light source passes is also provided. That lens device, however, also reflects a portion of the light generated from the light source. Collection optics are configured to capture the reflected portion of the light generated from the light source, and are configured to output the captured reflected light in a direction other than the primary direction, i.e. in a direction for the side emitting status indicators.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection to the accompanying drawings, wherein:

Fig. 1 shows a side view of the internal structure of the novel light device of the

present invention;

Fig. 2 shows a perspective view of the novel light device of the present invention with certain elements in an exploded view;

Fig. 3 shows a side view of the internal structure of the light device of the present invention that additionally indicates various light paths;

Fig. 4 shows a side internal view of specific collection optics for a side emitting status indicator in the novel light device of the present invention; and

Fig. 5 shows a perspective view of the collection optics for the side emitting status indicator of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, wherein like reference numerals identify identical or corresponding parts throughout the several views, and more particularly to Figs. 1 and 2 thereof, views of a light device 10 of the present invention are shown. Fig. 1 shows an internal view of the dialight device 10, and Fig. 2 shows the light device 10 from a perspective view with certain elements exploded out.

As shown in Figs. 1 and 2, the light device 10 includes an overall housing 6 that serves to house each of elements of the light device 10. The housing 6 can be formed of any suitable metal or plastic material. The light device 10 also includes a plurality of light emitting diode (LED) light sources 1. The number of LEDs 1 can vary based on the specific type of LEDs utilized.

The light device 10 also includes two lenses of an inner lens 2 and an outer lens 3. Light output from the LEDs 1 predominantly passes through the inner lens 2 and the outer lens 3 in a primary direction to provide a light indication signal. In the context of a railway indicator an oncoming motorist will view the light output from the LEDs 1 and passing through the inner lens 2 and the outer lens 3.

The light device 10 also includes additional side emitting status indicators formed of elements 4-8. The side emitting status indicators provide an indication signal in a direction other than the primary direction from which light from the LEDs is output. Element 4 is a light pipe that directs light collected at a collecting surface 7 to an exit surface 8. The exit surface 8 can be frosted to provide a diffused uniform illumination. The light pipe 4 may be

made from plastics or glass or other optical materials. The light pipe 4 is held in place by a sleeve 5. In the context of a railway indicator, a train operator will be able to view light output from the exit surface 8 to have an indication whether the LEDs 1 are properly operating, and to thereby give an indication whether an oncoming motorist is receiving a proper indication signal.

The operation of the output of light from the LEDs 1 is shown in further detail in Fig. 3, which shows the light device 10 with generated light beams.

With reference to Fig. 3, the LEDs 1 output primary light beams 11 to be output in a primary direction, i.e., the majority of the light beams 11 pass through the inner lens 2 and the outer lens 3 and then become viewable by, for example, an oncoming motorist. While the primary light beams 11 pass through the inner lens 2 and the outer lens 3, a portion of the primary light beams 11 are reflected at the surfaces of the inner lens 2 and the outer lens 3 based on Fresnel losses, and those reflected light beams result in Fresnel loss beams 12. Those Fresnel loss beams 12 are collected by the collecting surfaces 7 of the light pipes 4, which are formed on each side of the light device 10, although Fig. 3 only shows the collection of the Fresnel loss beams 12 at one of the light pipes 4. The collecting surfaces 7 of the light pipes 4 are formed with a plurality of prism elements 16 that refract light into the respective light pipes 4. The prisms elements can have any type of design such that most light reaching the sides of the light pipes 4 get total internal reflection. The light collected at the collecting surfaces 7 then travels through the respective light pipes 4 by total internal reflection, and then the collected light is output from the exit surfaces 8, to thereby provide output side emitting beams 14. The output side emitting beams 14 are visible to, for example, a train operator.

It is also the case that some light beams 13 output from the LEDs 1 will directly impinge on the collecting surfaces 7 of the light pipes 4 and also travel through the light pipes 4 and result in the side emitting beams 14. In fact, it may be adequate for only these light beams 13 to be collected if those light beams 13 provide enough illumination in the side emitting beams 14. In that instance the reflected Fresnel loss beams 12 need not be collected, although in an embodiment both the Fresnel loss beams 12 and direct light beams 13 are collected.

Further details of the side emitting status indicator light collecting devices of elements

4-8 is shown in Figs. 4 and 5. As shown in Fig. 4, the collecting surface 7 of the light pipe 4 includes prism elements 16 integrally formed on the collecting surface 7. Further, the sleeve 5 holds the light pipe 4 with a small air gap 15 therebetween. That is, a small air gap 15 is provided between the light pipe 4 and the sleeve 5, and that air gap 5 ensures the total internal reflection of the light beams passing through the light pipe 4.

Further, since the collecting surfaces 7 of the light pipe 4 are placed near the edge of the housing 6, as shown in Fig. 3, the main light beams 11 output by the LEDs 1 are not interfered with by the collecting surfaces 7, and thereby no shadowing is produced in the main output light beams 11.

Such a structure of the light device 10 provides side emitting signal indicators that provide a true indication of the light output from the same LEDs 1 providing light in a main light output direction. Thereby an enhanced safety operation is achieved.

The light device 10 as described above has been mainly described in the context of a railway indicator signal. However, it is apparent to those of ordinary skill in the art that the light device 10 can be used in other contexts in which a side indication whether a light signal is being output in a primary direction is desirable.

Obviously, numerous additional modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.